



LC230W01
Liquid Crystal Display

Product Specification

3-7. LUMINANCE CONTROLS

3.7.1 Luminance Control Method

Method	Adjustment and Luminance Ratio	PWSEL Signal	BRTP Signal	Notes						
Voltage Control	<div>- Adjustment This Control method can carry out continuation adjustment of luminance, If it is adjusted within the rated voltage for BRTI signal(VBI).</div> <div>- Luminance ratio(these data are the target values)</div> <table><tr><th>BRTI Voltage(VBI)</th><th>Luminance ratio</th></tr><tr><td>0V</td><td>20%(Minimum)</td></tr><tr><td>3.3V</td><td>100%(Maximum)</td></tr></table>	BRTI Voltage(VBI)	Luminance ratio	0V	20%(Minimum)	3.3V	100%(Maximum)	High or Open	Open	
BRTI Voltage(VBI)	Luminance ratio									
0V	20%(Minimum)									
3.3V	100%(Maximum)									
Pulse Width Modulation	<div>- Adjustment Pulse Width Modulation(PWM) method works, when PWSEL signal is Low and PWM signal(BRTP Signal) is inputted into BRTP terminal. The luminance is controlled by duty ratio of BRTP signal.</div> <div>- Luminance ratio(these data are the target values)</div> <table><tr><th>Duty ratio</th><th>Luminance ratio</th></tr><tr><td>0.2</td><td>20%(Minimum)</td></tr><tr><td>1.0</td><td>100%(Maximum)</td></tr></table>	Duty ratio	Luminance ratio	0.2	20%(Minimum)	1.0	100%(Maximum)	Low	PWM Signal	1
Duty ratio	Luminance ratio									
0.2	20%(Minimum)									
1.0	100%(Maximum)									

Notes : 1. See "3.7.2 Detail of PWM timing

2. The interference noise of luminance control frequency may appear on a display when investigating the matching characteristics. If display noises appear on the display image, the discussion with LPL should be done prior to implementation.



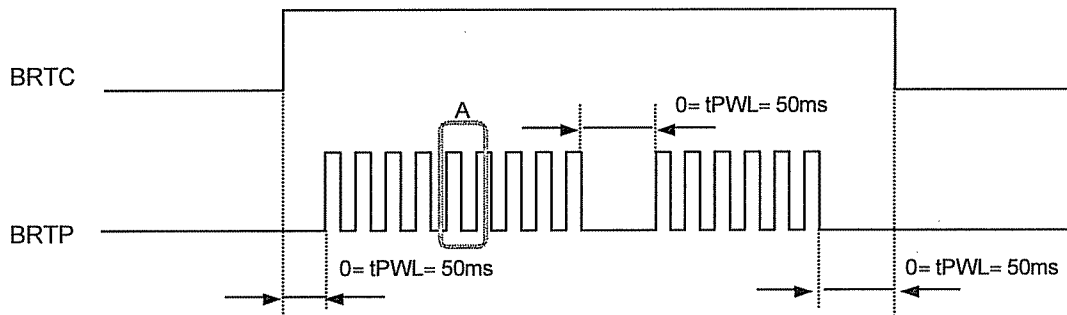
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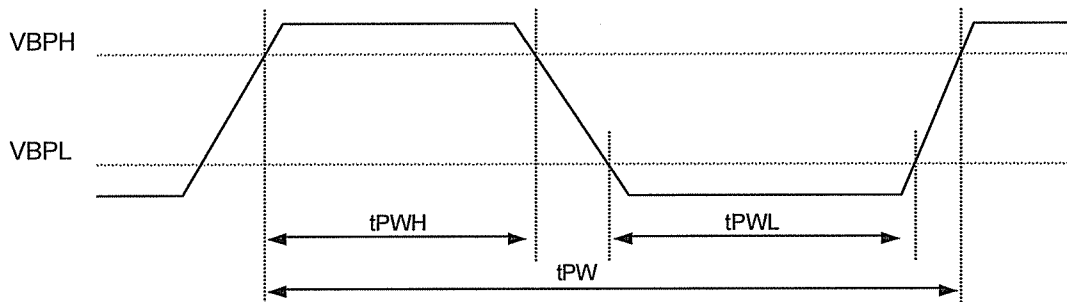
3.7.2 Detail of PWM Timing

3.7.2.1 Timing diagram

- Outline chart



- Detail of A part



3.7.2.2 Each parameter

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Luminance control frequency	FL	230	255	280	Hz	1, 2
Duty Ratio	DL	0.2	-	1.0	-	1, 3
Non signal Period	tPWL	0	-	50	Ms	4

Notes : 1. Definition of parameters is as follows

$$FL = \frac{1}{tPW} \quad , \quad DL = \frac{tPWH}{tPW}$$

2. See the following formula for luminance control frequency.

$$\text{Luminance control frequency} = tvv \times (n+0.25) [\text{or } (n+0.72)]$$

$n=1,2,3,\dots$

tvv : See "3.3 Signal timing specification"

The interference noise of luminance control frequency and input signal frequency for LCD panel signal processing board may appear on a display. Set up luminance control frequency so that the interference noise does not appear.

3. See "3.7.1 Luminance control methods"

4. If tPWL is more than 50ms, the backlight will be turned off by a protection circuit for inverter.



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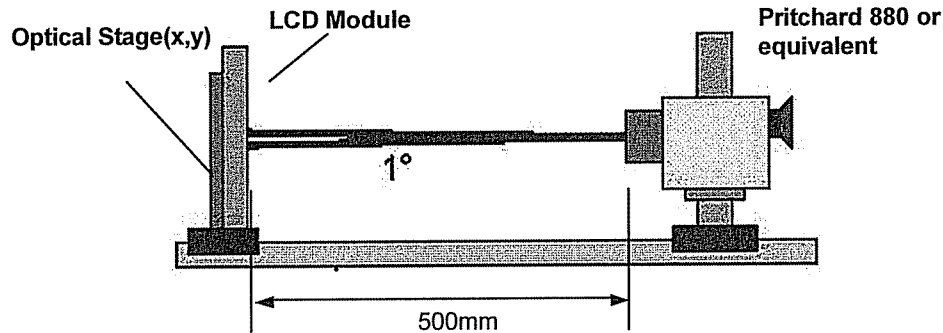
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4. Optical Specification

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 2Hrs in a dark environment at $25 \pm 2^\circ\text{C}$. The values specified are at an approximate distance 50cm from the LCD surface at a viewing angle of Φ and θ equal to 0° .

FIG. 1 presents additional information concerning the measurement equipment and method.

FIG. 1 Optical Characteristic Measurement Equipment and Method



$T_a: 25 \pm 2^\circ\text{C}$, $V_{\text{LCD}}: 12.0\text{V}$, $f_v: 60\text{Hz}$,
 $\text{Dclk}: 80\text{MHz}$, $I_{\text{Lamp}} = 6\text{mA}$

Table 10. OPTICAL CHARACTERISTICS

Parameter		Symbol	Values			Units	Notes
			Min	Typ	Max		
Contrast Ratio		CR	280	400			1
Surface Luminance, white		L_{WH}	300	450		cd/m^2	2
Luminance Variation		δ_{WHITE} 5P		-	1.3		3
Response Time	Rise Time	TrR		15	30	ms	4
	Decay Time	TrD		10	20		
Color Coordinates							
	RED	RX	Typ -0.03	0.635	Typ +0.03		
		RY		0.335			
	GREEN	GX		0.280			
		GY		0.603			
	BLUE	BX		0.145			
		BY		0.076			
	WHITE	WX		0.289			
		WY		0.304			
Viewing Angle (CR>10)							
	x axis, right ($\phi=0^\circ$)	θ_r	85	88	-	degree	5
	x axis, left ($\phi=180^\circ$)	θ_l	85	88	-		
	y axis, up ($\phi=90^\circ$)	θ_u	85	88	-		
	y axis, down ($\phi=270^\circ$)	θ_d	85	88	-		
Gray Scale				2.2			6



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Notes : 1. Contrast Ratio(CR) is defined mathematically as :

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

Surface luminance is the center point(1).

2. Surface luminance is the center point(1) across the LCD surface 50cm from the surface with all pixels displaying white under the condition of $I_{BL}=6mArms$. For more information see FIG 1.

3. The variation in surface luminance , δ WHITE is defined by measuring LON at watch test position 1 through 5, and then dividing maximum LON of 5 points luminance by minimum LON of each 5points luminance. For more information see FIG 2.

$$\delta \text{ WHITE} = \text{Maximum (LON1, LON2,, LON5)} / \text{Minimum (LON1, LON2,, LON5)}$$

4. Response time is the time required for the display to transition from black to white (Rise Time, TrR) and from white to black (Decay Time, TrD). For additional information see FIG 3.

5. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG 4.

6. Gray scale specification

Gray Level	Luminance [%] (Typ)
	TYP
L0	0.3
L15	0.65
L31	1.2
L47	2.5
L63	4.68
L79	7.8
L95	11.7
L111	16.0
L127	21.2
L143	27.7
L159	35.2
L175	43.5
L191	53.0
L207	63.7
L223	75.4
L239	86.4
L255	100



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FIG. 2 Luminance

<measuring point for surface luminance & measuring point for luminance variation>

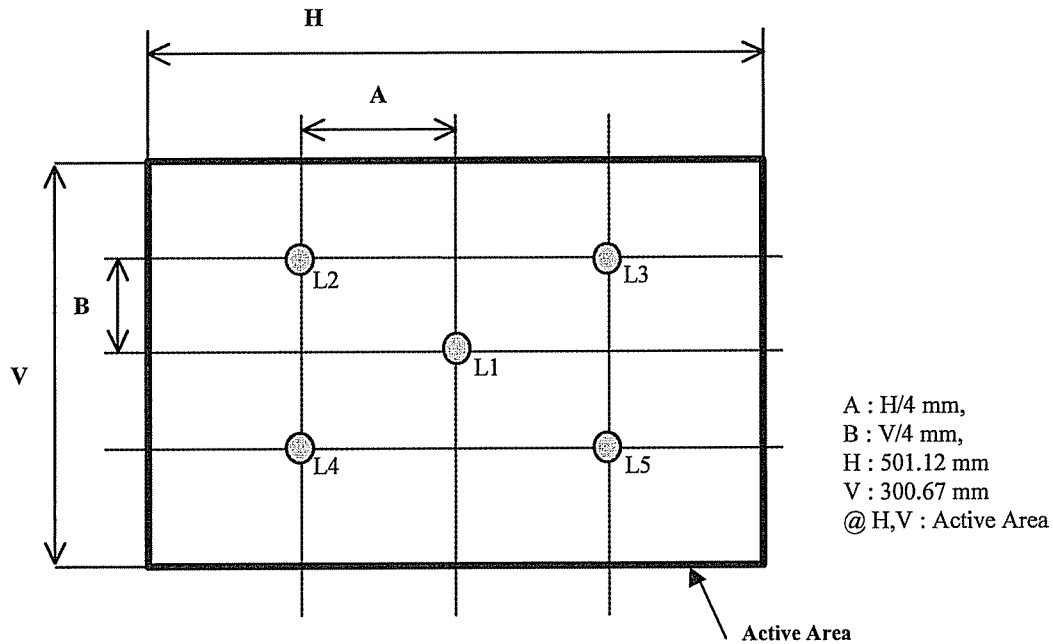
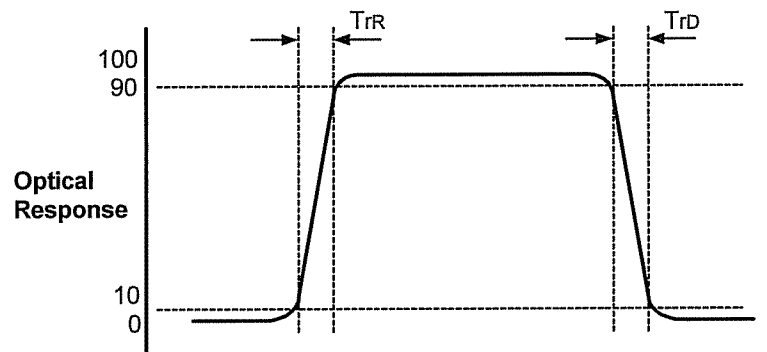


FIG. 3 Response Time

The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".



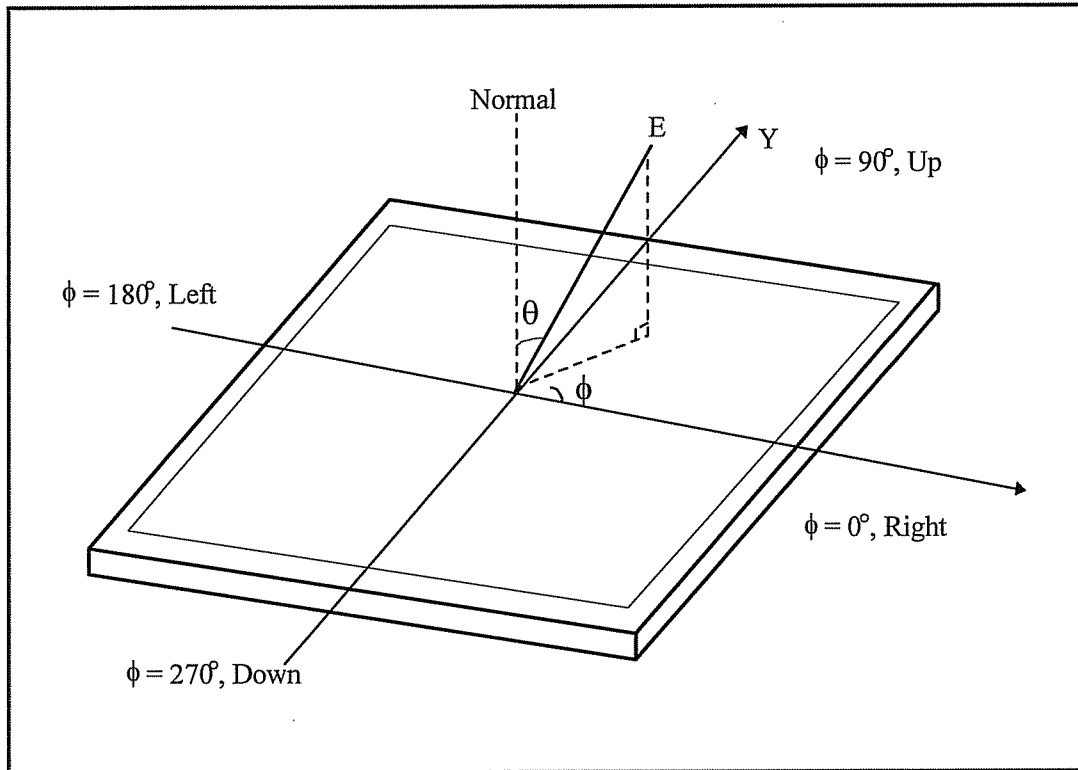


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FIG. 4 Viewing angle

<Dimension of viewing angle range>





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5. Mechanical Characteristics

The contents provide general mechanical characteristics for the model LC230W01. In addition the figures in the next page are detailed mechanical drawing of the LCD.

Outline Dimension	Horizontal	528.0mm
	Vertical	326.0mm
	Depth	34.5mm
Bezel Area	Horizontal	506.0mm
	Vertical	305.6mm
Active Display Area	Horizontal	501.12mm
	Vertical	300.67mm
Weight	2,700g (Typ.) , 2,800g (Max.)	
Surface Treatment	Hard coating(3H) Anti-glare treatment of the front polarizer	

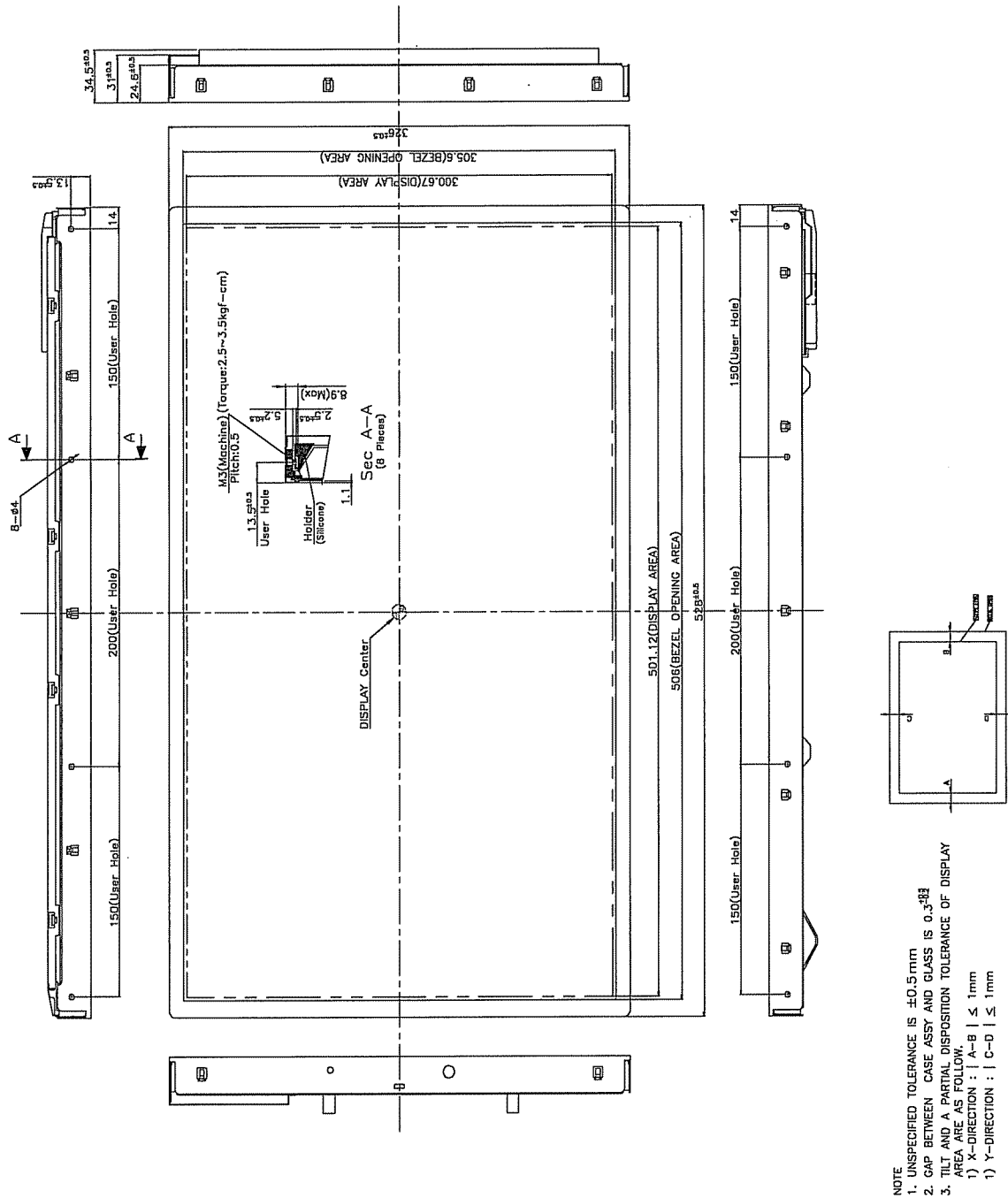
Note : See Attached Drawing(Front / Rear View)



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<FRONT VIEW>

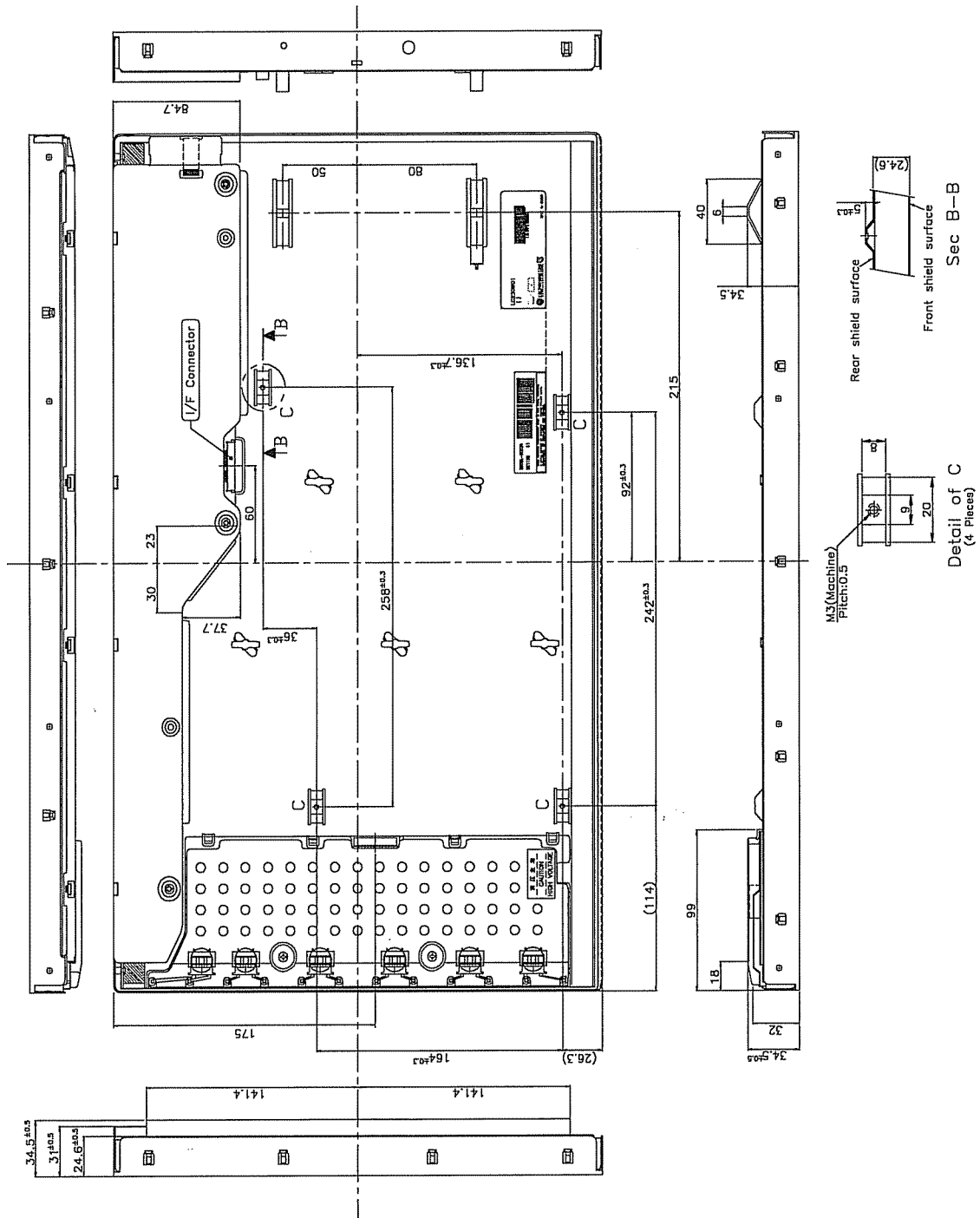




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<REAR VIEW>





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6. Reliability

Environment test condition

No	Test Item	Condition
1	High temperature storage test	Ta= 60°C 240h
2	Low temperature storage test	Ta= -20°C 240h
3	High temperature operation test	Ta= 50°C 50%RH 240h
4	Low temperature operation test	Ta= 0°C 240h
5	Vibration test (non-operating)	Wave form : random Vibration level : 1.0Grms Bandwidth : 10-500Hz Duration : X,Y,Z, 10 min One time each direction
6	Shock test (non-operating)	Shock level : 100Grms Waveform : half sine wave, 2ms Direction : $\pm X$, $\pm Y$, $\pm Z$ One time each direction
7	Humidity condition Operation	Ta= 40 °C ,90%RH
8	Altitude operating storage / shipment	0 - 14,000 feet(4267.2m) 0 - 40,000 feet(12192m)



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7. International Standards

7-1. Safety

- a) UL 60950, Third Edition, Underwriters Laboratories, Inc., Dated Dec. 11, 2000.
Standard for Safety of Information Technology Equipment, Including Electrical Business Equipment.
- b) CAN/CSA C22.2, No. 60950, Third Edition, Canadian Standards Association, Dec. 1, 2000.
Standard for Safety of Information Technology Equipment, Including Electrical Business Equipment.
- c) EN 60950 : 2000, Third Edition
IEC 60950 : 1999, Third Edition
European Committee for Electrotechnical Standardization(CENELEC)
EUROPEAN STANDARD for Safety of Information Technology Equipment Including Electrical Business Equipment.

7-2. EMC

- a) ANSI C63.4 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electrical Equipment in the Range of 9kHz to 40GHz. "American National Standards Institute(ANSI), 1992
- b) C.I.S.P.R "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." International Special Committee on Radio Interference.
- c) EN 55022 "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." European Committee for Electrotechnical Standardization.(CENELEC), 1998
(Including A1: 2000)



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8. Packing

8-1. Designation of Lot Mark

a) Lot Mark

A	B	C	D	E	F	G	H	I	J	K	L	M
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A,B,C : Inch

D : Year

E : Month

F : Panel Code

G : Factory Code

H : Assembly Code

I,J,K,L,M : Serial No

Note

1. Year

Year	97	98	99	2000	2001	2002	2003	2004	2005	2006	2007
Mark	7	8	9	0	1	2	3	4	5	6	7

2. Month

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mark	1	2	4	4	5	6	7	8	9	A	B	C

3. Panel Code

Panel Code	P1 Factory	P2 Factory	P3 Factory	P4 Factory	P5 Factory	Hydis Panel
Mark	1	2	3	4	5	H

4. Factory Code

Factory Code	LPL Gumi	LPL Nanjing
Mark	K	C

5. Serial No

Serial No.	1 ~ 99,999	100,000 ~
Mark	00001 ~ 99999	A0001 ~ A9999, ----, Z9999

b) Location of Lot Mark

Serial NO. is printed on the label. The label is attached to the backside of the LCD module.
This is subject to change without prior notice.

8-2. Packing Form

a) Package quantity in one box : 3 pcs

b) Box Size : 488mm X 245mm X 657mm



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9. PRECAUTIONS

Please pay attention to the followings when you use this TFT LCD module.

9-1. MOUNTING PRECAUTIONS

- (1) You must mount a module using holes arranged in four corners or four sides.
- (2) You should consider the mounting structure so that uneven force (ex. Twisted stress) is not applied to the module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
- (3) Please attach the surface transparent protective plate to the surface in order to protect the polarizer.
Transparent protective plate should have sufficient strength in order to resist external force.
- (4) You should adopt radiation structure to satisfy the temperature specification.
- (5) Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
- (6) Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.
Do not touch the surface of polarizer for bare hand or greasy cloth. (Some cosmetics are detrimental to the polarizer.)
- (7) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaked with petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
- (8) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- (9) Do not open the case because inside circuits do not have sufficient strength.

9-2. OPERATING PRECAUTIONS

- (1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage :
 $V = \pm 200\text{mV}$ (Over and under shoot voltage)
- (2) Response time depends on the temperature. (In lower temperature, it becomes longer.)
- (3) Brightness depends on the temperature. (In lower temperature, it becomes lower.)
And in lower temperature, response time (required time that brightness is stable after turned on) becomes longer.
- (4) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- (5) When fixed patterns are displayed for a long time, remnant image is likely to occur.
- (6) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.
- (7) Please do not give any mechanical and/or acoustical impact to LCM. Otherwise, LCM can not be operated its full characteristics perfectly.
- (8) A screw which is fastened up the steels should be a machine screw (if not, it causes metal foreign material and deal LCM a fatal blow)

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Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly.

9-4. PRECAUTIONS FOR STRONG LIGHT EXPOSURE

Strong light exposure causes degradation of polarizer and color filter.

9-5. STORAGE

When storing modules as spares for a long time, the following precautions are necessary.

- (1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
- (2) The polarizer surface should not come in contact with any other object.
It is recommended that they be stored in the container in which they were shipped.

9-6. HANDLING PRECAUTIONS FOR PROTECTION FILM

- (1) The protection film is attached to the bezel with a small masking tape.
When the protection film is peeled off, static electricity is generated between the film and polarizer. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.
- (2) When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the bezel after the protection film is peeled off.
- (3) You can remove the glue easily. When the glue remains on the bezel surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal -hexane.